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1986 TURFGRASS PEST CONTROL

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IMPROVED MANAGEMENT TECHNIQUES and new, more effective materials have made turfgrass culture a highly sophisticated technology. Proper irrigation, mowing, and fertilization practices remain the principal defenses against turfgrass pests, but it is sometimes necessary to control weeds, diseases, and insects with the intelligent selection and use of pesticides.

Pesticide formulations. Pesticides are active against one or more turfgrass pests. These chemicals are generally formulated as liquid concentrates—solutions (S) or emulsifiable concentrates (EC); as wettable powders (WP); and as granules (G). Liquid concentrates and wettable powders are usually added to water and applied to the turf with a sprayer. Granular materials can be applied with a fertilizer spreader.

Active ingredients. Pesticides must be accurately applied at correct rates to yield optimum results. Too little may control pests ineffectively; too much may injure the turf. The specific amount of material that should be applied depends upon the concentration of the pesticide (the "active ingredient") in the commercial preparation.

Concentration is usually expressed as a weight per unit volume or as a percent of the commercial preparation. For example, a 50 percent wettable powder is 50 percent active ingredients (a.i.) and 50 percent inert carrier. If the recommended rate of application is 12 pounds a.i. per acre, then 24 pounds of this commercial preparation are required to treat one acre. This is roughly equivalent to ½ pound per 1,000 sq. ft. (43,560 sq. ft. = 1 acre).

Liquid formulations generally list the number of pounds of the active ingredient per gallon (lb. a.i./gal.) on the pesticide label. For example, if the concentration is 4 lb./gal., then 1 quart of the product is required per acre to supply 1 pound of active ingredient per acre.

Precautions. Pesticides should be stored in their original containers with the label securely attached. Keep them in a cool, dry place that is inaccessible to children, pets, and irresponsible persons. **READ THE LABEL BEFORE USING THE PESTICIDE AND FOLLOW ALL INSTRUCTIONS CAREFULLY.** A few minutes spent studying the information on the label may prevent misuse and needless accidents.

WEED CONTROL

Herbicides control one or more plant species. They may be classified into one of three types—contact, systemic, or soil sterilant—depending upon the nature of their activity on plants.

Table 1. — Chemical Control of Broadleaf Weeds in Turf

	2,4-D ^a	MCPP ^b	Dicamba ^c	Combination of the three ^d
(S = susceptible; I = intermediate control; R = resistant)				
Black medic	R	I	S	S
Carpetweed	S	I	S	S
Chickweed,				
common	R	S-I	S	S
mouse-ear	R	S-I	S	S
Chicory	S	S	S	S
Daisy, oxeye	I	I	I	I
Dandelion	S	S-I	S	S
Dock, curly	I	I-R	S	S
Ground ivy	I-R	I	S-I	S
Hawkweed	S-I	R	S-I	S
Henbit	I	I	S	S
Knorweed	R	I	S	S
Lambsquarters	S	S	S	S
Mallow, roundleaf .	I-R	I	S-I	S
Plantain,				
broadleaf	S	I-R	R	S
buckhorn	S	I-R	R	S
Purslane	I	R	S	S
Red sorrel	R	R	S	S
Speedwell,				
creeping	R	R	R	I
purslane	I	I	I	S
Spurge, prostrate ..	I-R	I	S-I	S
Thistles	S-I	I	S	I
Violet*	R	R	R	R
White clover	I	S	S	S
Wild carrot	S	S-I	S	S
Wild onion	I	R	S-I	S
Woodsorrel, yellow.	I	I	I	S
Yarrow	I	I-R	S	S

Note: Bromoxynil may be used at ½ lb./A. for broadleaf control in seedling or newly-established turf.

^a A basic herbicide for use in combination with one or more of the others for broad-spectrum postemergence control of broadleaf weeds. Standard rate of application is 1 lb./A. Not recommended for use on bentgrass putting greens.

^b Safe for use on bentgrass putting greens at ½ to 1 lb./A. during cool weather periods. Can apply to general turf at 1 lb./A. with 2,4-D.

^c A very effective herbicide for broadleaf weed control when combined with 2,4-D or as a 3-way combination. Use at ¼ lb./A. with 2,4-D; use at ½ lb./A. with 2,4-D + mecoprop. Do not apply above roots of trees and shrubs.

^d Premixed combinations of 2,4-D, MCPP, and Dicamba are commercially available (Trimec and Trexan are two of the many products that are readily available).

* A combination of 2,4-D and triclopyr (Turflon D) can provide effective control of wild violets and other hard-to-control weeds.

Contact herbicides kill plant parts covered by the chemical. *Systemic herbicides*, absorbed by plant organs and translocated throughout the plant, may be either *selective*, killing certain weeds without injuring desirable grasses, or *nonselective*, controlling all vegetation.

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Glyphosate, a nonselective herbicide, is useful in renovating turfs infested with extensive populations of annual weeds. Glyphosate is also used to kill perennial weedy grasses, such as quackgrass, that cannot be controlled by selective herbicides. Because glyphosate has no residual soil activity, treated areas may be reseeded soon after application. Mecoprop is a selective herbicide used to control broadleaf weeds in turf.

Soil sterilants are chemicals that render the soil toxic

to all plant life. How long the soil remains sterile depends upon the material used, the rate of application, and the prevailing environmental conditions that affect decomposition of the herbicide in the soil. Soil sterilants have no place in turfgrass management; however, they are useful in preventing plant growth under fences and other areas that are difficult to mow.

Herbicides may be applied to prevent weeds from infesting a turf or to control weeds already present. Ben-

Table 2. — Chemical Control of Weed Grasses in Turf

Weeds	Life length	Herbicide	Rate (lb. a.i. per acre)	Remarks
Annual bluegrass	annual or perennial	benefin (Balan)	3	Apply in late summer. Do not use on bentgrass putting greens.
		bensulide (Betasan)	10	Apply in late summer before the return of cool weather to prevent development of new plants. Fairly safe for use on bentgrass putting greens.
		DCPA (Dacthal)	12	Apply in late summer. Do not use on Cohansey or Toronto bentgrass putting greens.
		ethofumesate (Prograss)	1.5	Use on perennial ryegrass or bermudagrass turf only. Has both preemergence and early postemergence activity. Apply in early spring and late summer.
		pendimethalin (Scotts turf-weedgrass control)	1.5-3	Apply in late summer. Do not use on bentgrass turf.
Crabgrass Foxtails Barnyardgrass	annual	benefin (Balan)	2	Apply before emergence of crabgrass in early spring. Not recommended for use on bentgrass turf.
		bensulide (Betasan)	7.5	Apply before emergence of crabgrass in early spring. Higher rates may be necessary for control of foxtails.
		DCPA (Dacthal)	10	Apply before emergence of crabgrass in early spring. May injure bentgrasses and fine-leaf fescues.
		siduron (Tupersan)	12	Apply before emergence of crabgrass in early spring. Use at half the recommended rate in conjunction with seeding Kentucky bluegrass. May injure some bentgrasses and fine-leaf fescues. Do not use on bermudagrass.
		pendimethalin (Scotts turf-weedgrass control)	1.5-3	Apply before emergence of crabgrass in early spring. Do not use on bentgrass turf or <i>Poa annua</i> turf.
Goosegrass	annual	organic arsenicals (DSMA, MSMA, etc.)	follow labels	Apply soon after emergence of crabgrass. Three applications at 7- to 10-day intervals are usually required. May cause some discoloration of the turf.
		DCPA (Dacthal)	15	Goosegrass is harder to control than crabgrass; complete control is rarely achieved. Better control may result if an early application is followed by a second at half the rate in early June.
Bentgrass Nimblewill Tall fescue Quackgrass Bermudagrass	perennial	oxadiazon (Ronstar)	3	Apply before emergence of crabgrass in early spring. Do not use on red fescue or bentgrass. Do not apply to wet turf.
		organic arsenicals (DSMA, MSMA, etc.)	follow labels	Apply soon after emergence. Three or more applications at 7- to 10-day intervals may be required for control. May cause some discoloration of the turf.
		amitrole	4	These give nonselective control. Amitrole and dalapon may persist in the soil for up to 4 and 6 weeks, respectively. Overseeding should be delayed until chemical residues have dissipated. Glyphosate has no residual activity in the soil; repeated treatments may be necessary for complete control.
Nutsedge	perennial	dalaphon	10	
		glyphosate	2	
Nutsedge	perennial	bentazon	1	Treat soon after emergence before new nutlets form. Repeat application as necessary for control, up to a total of 3 lb. a.i. per acre per season.

sulide is a *preemergence* herbicide applied in spring to prevent development of crabgrass. Once the weed has germinated, DSMA may be used as a *postemergence* treatment to selectively control the crabgrass invader.

INSECT CONTROL

Insecticides are pesticides that reduce insect populations below levels that are injurious to turf. Although insecticide chemistry is quite varied, most of the commonly used materials act as contact poisons. Effective control is dependent upon ensuring contact between the insect and the insecticide. Control of soil-inhabiting insects (such as grubs) is best achieved by drenching the insecticide into the soil, whereas foliar-feeding insects (for example, sod webworms) should be controlled by a foliar spray with no irrigation or rainfall for at least 24 hours afterwards.

Most insecticide applications are for control — the insect is controlled after the early signs of injury have been observed. No single insecticide will control all insect pests found in turf. Identify the specific insect before attempting control with an insecticide. Learn to recognize early signs of insect injury to avoid wide-scale loss of turf.

DISEASE CONTROL

Fungicides are pesticides that kill or inhibit the growth of disease-causing fungi. Depending upon the manner in which they protect plants against infection, fungicides are of two general types: protective-contact and systemic.

Protective-contact fungicides are applied to seed, foliage, or soil to keep disease-causing fungi from entering plants. This kind of fungicide must be applied fairly frequently to turf (7- to 21-day intervals) since mowing and irrigation remove much of the surface chemical soon after application. Relatively high spray volumes (5 gal. water per 1,000 sq. ft.) are required to supply uniform and continuous coverage of the foliage by the fungicide. Adding spreader-stickers (surfactants) to the spray mixture facilitates good foliar coverage. Most of the available fungicides for turf are the protective-contact type.

Systemic fungicides, or chemotherapeutants, are absorbed and distributed within the plant, destroying established infections and controlling certain diseases for several weeks or months. These fungicides are absorbed principally by the roots and hence should be drenched or watered in for best results. Examples of systemic fungicides are benomyl (Tersan 1991), chloroneb (Terraneb SP), and etridiazole (Koban).

Table 3. — Chemical Control of Insects

Insect	Insecticide ^a	Formulation ^b	Suggestions
Annual white grubs	diazinon	EC or G	Apply as spray or granules to small area and then <i>water in thoroughly</i> before treating another small area. Grub damage will usually occur in late August and September. <i>Ataenius</i> grubs occur in June, July, and September.
Ataenius grubs	trichlorfon (Dylox, Proxol)	SP or G	
	isofenphos (Oftanol)	G or EC	
	bendiocarb (Turcam)	WP	
Cicada killer and other soil-nesting wasps	diazinon	EC or G	Apply as spray or granules and water in thoroughly. For individual nests pour 1% diazinon in nest and seal in with dirt.
Ants			
Sod webworms	carbaryl (Sevin)	WP or G	Webworms usually damage lawns in late July and August. As sprays, use at least 2½ gal. water per 1,000 sq. ft. Do not water for 72 hours after treatment. As granules, apply from fertilizer spreader.
	diazinon	EC or G	
	chlorpyrifos (Dursban)	EC or G	
	trichlorfon (Dylox, Proxol)	SP or G	
Millipedes and sowbugs	carbaryl (Sevin)	WP or G	Spray around home where millipedes or sowbugs are crawling. If numerous, treat entire lawn.
	diazinon	EC or G	
Armyworms	carbaryl (Sevin)	WP or G	Apply as sprays or granules. Use 5 to 10 gal. of water per 1,000 sq. ft.
Cutworms	chlorpyrifos (Dursban)	EC or G	
	trichlorfon (Dylox, Proxol)	SP or G	
Chinch bugs	chlorpyrifos (Dursban)	EC	Spray infested areas where chinch bugs are present.
	diazinon	EC	
	trichlorfon (Dylox, Proxol)	SP	
Aphids	acephate (Orthene)	EC	Spray grass thoroughly.
	chlorpyrifos (Dursban)	EC	
Chiggers	diazinon	EC	Spray grass thoroughly.
Slugs	Mesurool	bait	Apply where slugs are numerous. Scatter in grass. For use only in flower gardens and shrubbery beds.

^a Use one of the insecticides recommended for a given group of insects, being sure to use the proper dosage for the formulation chosen. Follow labels as to correct rate of application.

^b E.C. = emulsion concentrate; W.P. = wettable powder; G = granules; SP = soluble powder.

Table 4. — Chemical Control of Turfgrass Diseases

Diseases ^a	Principal turfgrasses affected	Normal season and intervals of application	Fungicide preparations (oz. per 1,000 sq. ft.) ^b
"Helminthosporium" diseases			
Leaf spot, Melting-out (<i>Drechlera poae</i>)	Kentucky bluegrass	March-June; Sept.-Nov. 7 to 21 days	Acti-dione RZ (1.2 oz.) Acti-dione Thiram (2 to 4 oz.) Acti-dione TGF (2 oz.) Bromosan (see label)
Leaf spot, crown and root rot (<i>Bipolaris sorokinianum</i>)	All turfgrasses	May-Sept. 7 to 21 days	Chipco 26019 WP 50% (2 oz.) Daconil 2787 WP 75% or 500 (4 to 11 oz.)
Zonate eyespot (<i>Drechlera giganteum</i>)	Bermudagrass Bluegrasses Bentgrasses	June-Sept. 7 to 21 days	Duosan WP 75% (4 to 6 oz.) Dyrene or Dymec WP 50% (4 to 8 oz.) Fore or Formec 80 WP 80% (4 to 6 oz.) Kromad WP (3 to 6 oz.)
Net blotch, crown and root rot (<i>Drechlera dictyoides</i>)	Fescues Ryegrasses	March-July 7 to 21 days	Manzate D WP 80% (4 to 8 oz.) PCNB (Terraclor) WP 75% (see label) Tersan LSR WP 80% (4 to 8 oz.) Vorlan WP 50% (2 oz.)
Brown blight (<i>Drechlera siccans</i>)	Ryegrasses	April-June 7 to 21 days	
Leaf blotch (<i>Bipolaris cynodontis</i>)	Bermudagrass	March-June 7 to 21 days	
Red leaf spot (<i>Drechlera erythrospila</i>)	Bentgrasses	April-Sept. 7 to 21 days	
Summer patch and necrotic ring spot (<i>Phialophora graminicola</i> and <i>Leptosphaeria korrae</i>)	Bentgrasses Bluegrasses Fescues Ryegrasses Bermudagrass	April-Sept.	Banner (see label) or Bayleton WP 25% (4 to 8 oz.) or Chipco 26019 WP 50% (4 oz.) or Cleary's 3336 (6 to 8 oz.) plus Fungo WP 50% (4 to 8 oz.) or Rubigan WP 50% (2 to 4 oz.) or Tersan 1991 WP 50% (5 to 8 oz.)
<i>Comments:</i> Apply when disease is expected or first appears. Repeat in 14 to 21 days if necessary. Drench fungicide into root zone using ½ inch (300 gal.) of water per 1,000 sq. ft. Water the turf thoroughly the day before (300 to 450 gal. water per 1,000 sq. ft.).			
Dollar spot (<i>Lanzia</i> and <i>Moellerodiscus</i> spp.)	All turfgrasses	May-Nov. 7 to 14 days	Acti-dione Thiram (2 to 4 oz.) Acti-dione TGF (1 to 2 oz.) Banner (see label)
Red thread or pink patch (<i>Laetisaria fuciformis</i> and <i>Limonomycetes roseipellis</i>)	All turfgrasses	April-June; August-Nov. 7 to 14 days	Bayleton WP 25% (1 to 2 oz.) Bromosan (see label) cadmium compounds (see label) Chipco 26019 WP 50% (2 oz.) Daconil 2787 WP 75% or 500 (4 to 11 oz.) Duosan WP 75% (3 to 6 oz.) Dyrene or Dymec WP 50% (3 to 8 oz.) Fungo WP 50% (2 oz.) Kromad WP (3 to 6 oz.) Rubigan WP 50% (0.2 to 0.4 oz.) Tersan 1991 WP 50% (1 to 2 oz.) thiram WP 75% (4 oz.) Vorlan WP 50% (2 oz.)
<i>Comments:</i> Resistance to cadmium compounds, benomyl, thiophanate materials, Dyrene, and other fungicides has been reported in some areas. Using combinations of active ingredients or alternating between products is advisable.			
Rhizoctonia brown patch (<i>R. solani</i>)	All turfgrasses	May-Oct. 5 to 14 days	Chipco 26019 WP 50% (2 oz.) Daconil 2787 WP 75% or 500 (3 to 11 oz.) Duosan WP (4 to 6 oz.) Dyrene or Dymec WP 50% (4 to 8 oz.) Fungo WP 50% (2 to 3 oz.) Kromad WP (3 to 6 oz.) Rubigan WP 50% (0.4 to 0.8 oz.) Tersan 1991 WP 50% (2 to 3 oz.) Vorlan WP 50% (2 oz.)
Rusts: leaf and stem (<i>Puccinia</i> spp.)	All turfgrasses, especially certain cultivars of Kentucky bluegrass, Perennial ryegrass, Zoysiagrass, and Bermudagrass	June-Oct. 7 to 14 days	Acti-dione Thiram (4 oz.) Acti-dione TGF (2 oz.) Bayleton WP 25% (1 to 2 oz.) Daconil 2787 WP 75% or 500 (4 to 11 oz.) Duosan WP 75% (4 to 6 oz.) Dyrene WP 50% (4 to 8 oz.) Fore or Formec 80 WP 80% (2 to 4 oz.) zineb WP 75% (2 to 4 oz.)

^a Causal fungus listed in parentheses.^b Denotes either fungicide, coined name of that material, or representative trade names. Mention of a trade name or proprietary product does not constitute warranty of the product and does not imply approval of this material to the exclusion of comparable products that may be equally suitable. Except where indicated, all materials should be applied in 3 to 5 gal. of water per 1,000 sq. ft. Use lower fungicide rates in *preventive* programs, higher rates for *curative* programs. Only one from each recommended group of preparations need be used. Fungicide use and restrictions are subject to change without notice. Always read and follow the current package label instructions and precautions.


Table 4. — Chemical Control of Turfgrass Diseases (contine

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Diseases*	Principal turfgrasses affected	Normal season and intervals of application	
Anthracnose (<i>Colletotrichum graminicola</i>)	All turfgrasses, especially annual bluegrass	June-Sept. 7 to 21 days	Bayleton Daconil 2 Duosan WP 75% (3 to 6 oz.) Fungo WP 50% (1 to 2 oz.) Rubigan WP 50% (2 to 4 oz.) Tersan 1991 WP 50% (1 to 2 oz.)
Leaf smuts Stripe smut (<i>Ustilago striiformis</i>) Flag smut (<i>Urocystis agropyri</i>)	All turfgrasses, especially certain bentgrasses, bluegrasses, and ryegrasses	Oct.-Nov.	Bayleton WP 25% (6 to 8 oz.) or Fungo WP 50% (6 to 8 oz.) or Rubigan WP 50% (4 oz.) or Tersan 1991 WP 50% (6 to 8 oz.) plus PCNB (Terraclor) WP 75% (see label)
Comments: Make two applications, 14 to 21 days apart. Drench fungicide into soil, using 1 inch (600 gal.) water per 1,000 sq. ft., immediately after application.			
Powdery mildew (<i>Erysiphe graminis</i>)	Bluegrasses Bermudagrass Fescues	March-Nov. 7 to 14 days	Acti-dione Thiram (2 to 4 oz.) Acti-dione TGF (1 to 2 oz.) Bayleton WP 25% (5 to 8 oz.) Fungo WP 50% (1 to 2 oz.) Tersan 1991 WP 50% (1 to 2 oz.)
Snow molds Typhula blight (<i>T. species</i>) Fusarium patch (<i>F. nivale</i>)	All turfgrasses	Nov.-March see label for interval	Bayleton WP 25% (5 to 8 oz.) Chipco 26019 WP 50% (2 to 4 oz.) Calo-clor, Calo-Gran (see label)* Daconil 2787 WP 75% or 500 (8 to 11 oz.) PCNB (Terraclor) WP 75% (see label) Rubigan WP 50% (2 to 4 oz.) Teremec SP or Terraneb SP WP 65% (6-9 oz.)
Pythium blight, grease spot, spot blight (many <i>P. species</i>)	All turfgrasses	April-Nov. 5 to 10 days	Banol WP 65.5% (1½ to 4 oz.) Koban WP 35% (4 to 8 oz.) Subdue 2E WP 25% (1 to 2 oz.) Terra-zole WP 35% (4 to 8 oz.) Teremec SP or Terraneb SP WP 65% (4-6 oz.)
Comments: Apply fungicide in 10 gal. water per 1,000 sq. ft.			
Fairy rings (<i>Marasmius oreades</i> , <i>Agaricus</i> or <i>Psalliota campestris</i> , <i>Chorophyllum</i> [<i>Lepiota</i>] species)	All turfgrasses		methyl bromide chloropicrin Vapam Soil Fumigant Vorlex formaldehyde
Comments: Soil temperature should be above 60° F. for fumigation. Cover area with gas-proof cover for several days, or instead of treating with fungicide, use root feeder attachment on hose to drench rings with water. Repeat when symptoms reappear.			
Seed rot, damping off, seedling blights (<i>Pythium</i> sp., <i>Fusarium</i> sp., <i>Rhizoctonia solani</i> , <i>Helminthosporium</i> sp., <i>Colletotrichum graminicola</i>)	All turfgrasses	Treat seed before planting. Spray at early seedling emergence and 7 to 10 days later (see labels).	captan or thiram 50% to 75%, plus Koban WP 35% or Apron (see label) Koban WP 35% or Subdue 2E WP 25% plus one of these: captan WP 50% Chipco 26019 WP 50% Dyrene or Dymec WP 50% zineb WP 75%
Nematodes (many genera and species)	All turfgrasses	fenamiphos (Nemacur), ethoprop (Mocap, Proturf Nematicide, or fensulfothion (Dasanit): granules.	
Comments: Follow the manufacturer's directions carefully. Follow nematicide immediately with at least ½ inch of water to ensure penetration into soil to prevent toxic effects. Treat in fall or spring (or both, if nematodes are a serious problem) when soil temperature is above 55° F. Aerifying turf before application improves results. Do not apply to newly seeded areas. For use only by certified pesticide applicators.			
Slime molds (<i>Physarum cinereum</i> , <i>Fuligo</i> sp., <i>Mucilago spongiosa</i> , <i>Stemonitis</i> spp.)	All turfgrasses	May-Sept. Mow, rake, pole, or hose down to remove mold when seen. Controlled by any fungicide listed for "Helminthosporium" diseases.	
Algae, green or black scum	All turfgrasses	Apply when first seen; reapply as needed.	copper sulfate (1 to 2 oz.) Daconil 2787 WP 75% or 500 (4 to 11 oz.) Fore or Formec WP 80% (4 to 6 oz.)
Moss	All turfgrasses	Apply when first seen; reapply as needed.	ferrous ammonium sulfate (1 to 4 lbs.) ferric sulfate (1 to 4 lbs.)

* Cleared for use only on golf course greens, aprons, and tees by certified golf course superintendents.



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